



RESEARCH COUNCIL OF ALBERTA

Information Series No. 57

ALBERTA MOTOR GASOLINE SURVEY

1968

by

J. S. Charlesworth and G. Stott



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Research Council of Alberta
87th Avenue and 114th Street
Edmonton, Alberta
1968

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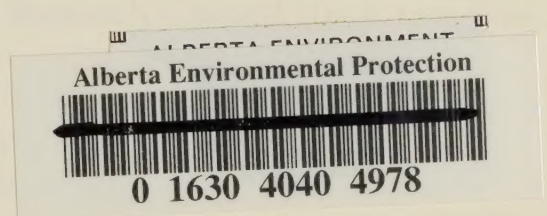
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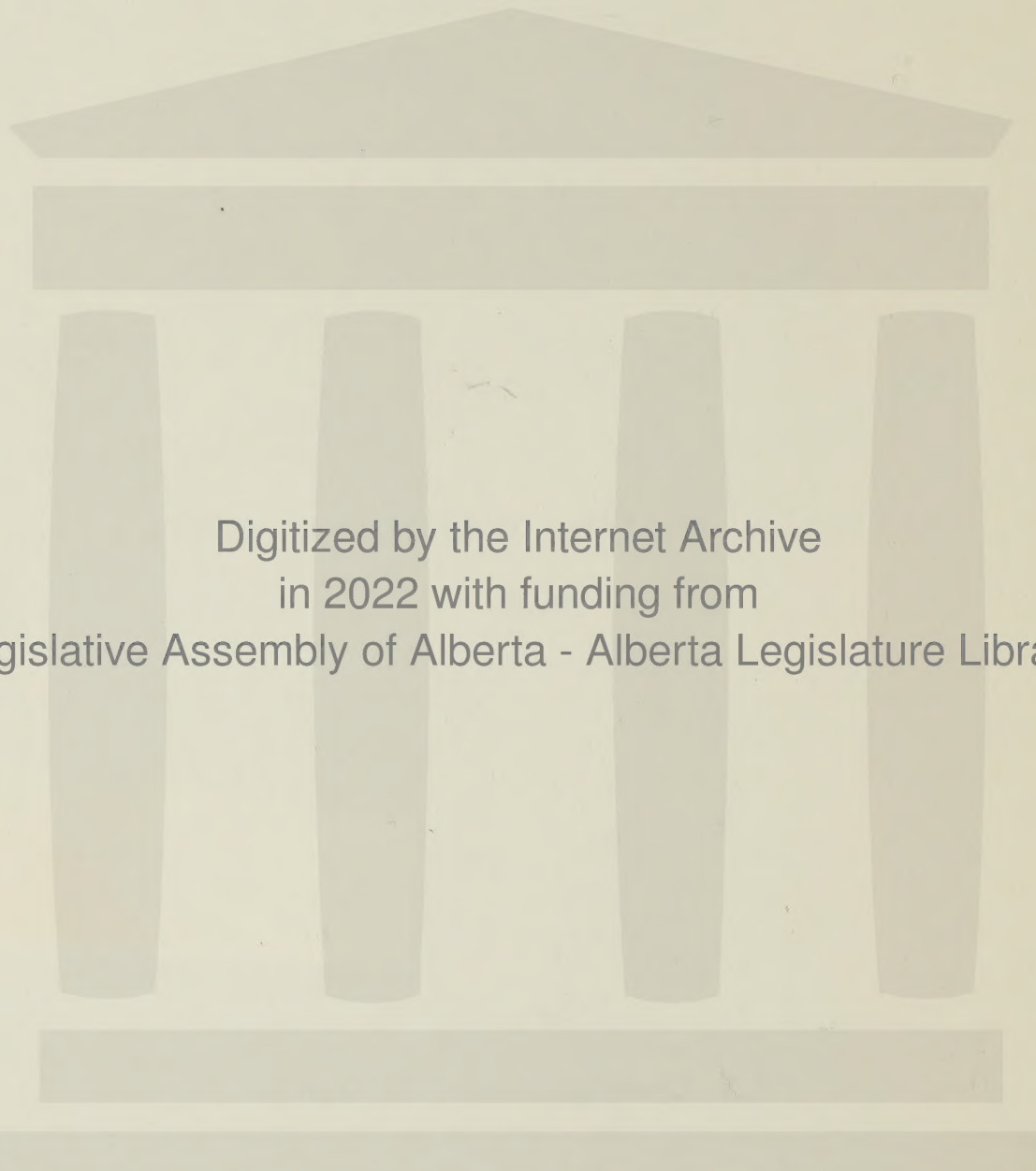
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ALBERTA MOTOR GASOLINE SURVEY

1968

In 1939 at the request of the Provincial Government, the Research Council of Alberta made a study of the quality of motor gasoline sold in the Province of Alberta. The results obtained from this survey were later used as the basis for establishing Alberta Standard Specifications for motor gasoline. These specifications were published as Regulations under amendments to the Fuel Oil Licensing Act of 1936 and became effective in the spring of 1941.

During the war years from 1942 to 1945 the Alberta specifications were rendered non-active since the quality of gasoline for the whole of Canada came under the jurisdiction of the Dominion Oil Controller. Following the war the Alberta Government regulations again came into effect. They have been revised from time to time in order to keep them in line with consumer needs and modern refinery practice.

During 1955 the Canadian Government Specifications for gasoline were amended. Recognizing that there had been an industrial shift from the motor to the research method of determining octane numbers, the major change made was to specify octane numbers by the research test procedure and new specification values were established accordingly. No corresponding change was made in the Alberta Government Specifications at that time; however, one test engine at the Research Council was immediately converted to the research test procedure. Octane ratings have been made by both test methods in the Research Council since that time.

In 1957 it was decided that the Alberta specifications should be similarly revised and brought into line with those of the Canadian Government. These revisions became effective May 7, 1958. In addition to the change in octane ratings, a few other minor changes were also made.

In 1961 the Canadian Government Specifications were again revised. In addition to some minor alterations, two significant changes were made: firstly, a sharp increase in the minimum requirement for octane number and, secondly, a substantial increase in the maximum allowable quantity of lead. Furthermore, the reporting of lead values was changed from millilitres per imperial gallon to grams of lead per imperial gallon. The need for an upward revision in minimum octane numbers was obvious, as automotive demand had resulted in refinery production of gasolines having octane numbers far above existing specification limits. The need for an upward revision of lead was not so clearly evident, and although it was strongly recommended by the producers of lead anti-knock compounds, it was granted only after careful consideration based on a study of the situation in the United States and on requests for an increase on the part of some Canadian refiners.

Late in 1961 it was decided that the Alberta specifications should be similarly revised. The revisions became effective on June 7, 1962. Attached as appendix 1 to this report is a copy of the current (1962) Alberta Standards for Gasoline as listed under the Regulations of the Fuel Oil Licensing Act. Attached as appendix 2 is a tabulation of the changes made in Alberta specifications since they were established in 1941. Attached as appendix 3 are brief notes on the significance of the specifications.

From 1939 to 1954 the study of gasoline quality was maintained by systematic surveys, the samples of gasoline for test purposes being purchased at regular retail outlets and at regular retail prices. The information obtained from these surveys has been published as Research Council Information Series Reports*. Following completion of the 1954 survey it was decided that no further annual studies would be required unless warranted by special circumstances. No survey was made in 1955.

During the latter part of 1955 and early in 1956 reports were constantly being received of a marked increase in octane ratings – both research and motor. It was decided, therefore, to review again the Alberta situation in 1956. The reports of much higher octane ratings were proven correct by this survey. While previous data indicated that this trend started in 1945, it was evident that the greatest increase had taken place since 1954. Reports of further increases continued after 1956, and with revisions in the Alberta specifications imminent it was decided to again review the situation in 1958. As was the case in 1956, the 1958 data showed a further marked increase in octane ratings. However, the increase was not as great as that shown for the previous two years. Between 1958 and 1962, octane levels for both motor and research methods remained relatively stable. A slight upward trend was noted between 1962 and 1966. The current survey does not indicate any significant change since 1966.

The Alberta Specifications for Gasoline provide for the classification of samples into four groups, namely, Premium grade, Regular grade, and for each of the foregoing, Summer grade and Winter grade. As has been the case in previous years this report for 1968 provides, in summary form, information on the general quality level of Alberta gasolines as of January (winter) and June (summer) of 1968. Comparison data from previous reports are also included. As in all surveys since 1953, sampling was confined largely to the cities of Calgary and Edmonton although a few samples were obtained from other locations in the Province.

* R.C.A. Information Series Nos. 2, 4, 8, 9, 11, 14, 16, 19, 21, 27, 31, 41, 51, and 55 represent Alberta Motor Gasoline Surveys, 1939 to 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1956, 1958, 1960, 1962, 1964, and 1966 respectively.

Test data in this report are based on the latest standard test procedures of the American Society for Testing Materials (A.S.T.M.). They are as follows: Octane number, A.S.T.M. method D-357 and A.S.T.M. method D-908; Lead, A.S.T.M. method D-526; Reid vapour pressure, A.S.T.M. method D-323; Gravity at 60° Fahrenheit in degrees A.P.I., A.S.T.M. method D-287; Distillation range in degrees Fahrenheit on a basis of percentage evaporated, A.S.T.M. method D-86; Sulfur content, A.S.T.M. method D-1266; Gum content, A.S.T.M. method D-381; Corrosion, A.S.T.M. method D-130.

Tables I and II list the average, the maximum, and the minimum values obtained for each test for both Premium and Regular grades of Winter and Summer gasolines respectively. For comparative purposes the Alberta specification limits are also shown.

Tables III, IV, V, and VI list, for comparative purposes, the 1968 data and similar data from previous years.

Table VII lists the total number of samples which failed on each specification test in the complete survey.

Table VIII lists the data for northern and for southern Alberta, averaged separately.

Figure 1 and Figure 2 show, in graphical form, the variations and trends in Distillation, Vapour Pressure and Octane Ratings from 1942 to 1968, for Premium and Regular grades respectively.

Table VIII shows that there is a slight difference in octane ratings between the gasolines from northern and southern Alberta. Minor differences may also be noticed in the distillation ranges, gravity, and lead content.

Four points of particular interest to be noted from a comparison of the 1968 data with the data from 1966 and previous years are:

1. Research and motor octane values of both Premium and Regular grade gasolines have not changed significantly.
2. The over-all volatility of the gasoline has decreased slightly.
3. The average quantity of lead used has increased very slightly.
4. The total number of samples failing to comply with specification limits has increased sharply. While only 3 samples out of a total of 161 failed to comply with all requirements on the 1966 survey, 14 samples out of a total of 270 failed to comply with all requirements in this survey. However the degree of failure was trivial in most cases.

Table I. Summary of Analytical Data Winter Gasolines - January 1968

	Premium Grade Gasoline				Regular Grade Gasoline			
	Spec.	Ave.	Max.	Min.	Spec.	Ave.	Max.	Min.
	(Number of Samples 78)				(Number of Samples 78)			
Octane Number:								
Research	95	96.9	98.3	95.1	89	91.3	93.2	89.7
Motor		88.1	90.7	85.4		83.6	86.6	81.7
Lead, gm./gal.	5.05	2.77	3.75	1.53	5.05	2.17	3.46	0.86
Vapour Pressure, lbs.	9	12.1	14.2	9.3	9	12.2	13.6	10.5
Gravity, °A.P.I.	14				14			
Distillation Range, °F.		63.3	68.0	56.8		65.5	68.0	62.3
I.B.P.		89	102	82		89	102	82
10%	95	107	124	97	95	107	120	98
	125				125			
50%	235	189	217	172	235	188	213	165
90%	365	305	329	284	365	302	321	283
E.P.		376	426	344		377	409	352
Sulphur, %	0.15	0.03	0.06	0.01	0.15	0.04	0.09	0.02
Gum, mgm./100 ml.	7	1.5	18.6	0.0	7	0.7	16.4	0.0
Corrosion	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Colour	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow

Table II. Summary of Analytical Data Summer Gasolines — June 1968

	Premium Grade Gasoline				Regular Grade Gasoline			
	Spec.	Ave.	Max.	Min.	Spec.	Ave.	Max.	Min.
Octane Number:								
Research								
Motor								
Lead, gm./gal.	Min. 95	96.9	97.9	95.7	Min. 89	91.4	93.6	90.0
	Max. 5.05	88.5	90.9	86.6	Max. 5.05	84.1	86.8	82.6
Vapour Pressure, lbs.	Max. 11	3.18	3.81	2.41	Max. 11	2.89	3.87	1.85
Gravity, °A.P.I.		10.1	11.8	8.6		9.9	10.6	9.0
Distillation Range, °F.		60.6	66.7	55.3		62.8	64.8	60.1
I.B.P.		93	101	87		92	101	86
10%	Min. 110	119	129	109	Min. 110	118	129	108
	Max. 135				Max. 135			
50%	Max. 245	203	229	184	Max. 245	201	216	179
90%	Max. 365	314	333	291	Max. 365	316	349	292
E.P.		391	433	366		390	422	366
Sulphur, %	Max. 0.15	0.03	0.06	0.01	Max. 0.15	0.05	0.10	0.02
Gum, mgm./100 ml.	Max. 7	0.2	1.4	0.0	Max. 7	0.4	1.8	0.
Corrosion	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Colour	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow

(Number of Samples 57)

(Number of Samples 57)

Table III. Average Analysis of Winter Gasolines Premium Grade, 1940 - 1968

Year	Octane Number		Lead, gm./gal.	Vapour Pressure	Gravity, °A.P.I.	Distillation Range, °F.				Sulphur, %	Gum, mgm./100 ml.
	Research	Motor				I.B.P.	10%	50%	90%		
1940		78.3		10.5	63.3	91	127	229	342	0.06	2.0
1942		75.6		10.6			131	240	340	0.04	2.2
1943		76.3		9.9			130	239	353	0.06	1.3
1944		75.4		9.2			131	251	364	0.04	1.4
1945		73.9		9.4	60.4	90	124	244	356	0.06	2.8
1946		77.1		9.1	62.0	93	125	223	343	0.05	2.8
1947		76.1	2.07	9.9	62.8	89	120	230	335	0.05	2.3
1948		77.3	3.15	9.8	62.0	94	128	235	339	0.06	2.6
1949		77.1	3.12	10.1	62.0	88	120	229	335	0.06	2.8
1950		76.0	2.40	10.2	62.2	95	123	227	338	0.05	1.7
1951		77.0	2.55	10.5	63.1	89	120	227	341	0.06	1.4
1952		78.0	2.60	10.6	62.1	98	123	223	338	0.06	1.5
1953		80.3	1.43	10.5	61.6	96	122	220	339	0.05	1.7
1954		80.4		10.7	61.5	93	119	227	338	0.06	1.4
1958	94.7	85.6	2.94	11.4	60.9	94	117	217	324	0.04	1.9
1960	95.9	86.9	3.31	12.4	60.9	86	110	212	319	0.04	2.3
1962	95.9	88.4	2.82	11.2	61.9	92	111	200	314	0.03	0.7
1964	96.5	87.9	2.62	12.1	62.6	88	109	196	304	0.04	0.7
1966	97.0	88.4	2.35	12.2	63.9	86	106	188	299	0.03	1.3
1968	96.9	88.1	2.77	12.1	63.3	89	107	189	305	0.03	1.5

Table IV. Average Analysis of Summer Gasolines Premium Grade, 1940 - 1968

Year	Octane Number		Lead, gm./gal.	Vapour Pressure	Gravity, °A.P.I.	Distillation Range, °F.			Sulphur, %	Gum, mgm./100 ml.
	Research	Motor				I.B.P.	10%	50%	90%	E.P.
1940		77.4		8.5	60.0	101	139	245	350	400
1941		76.6		8.5	60.3	92	133	246	354	403
1942		76.2		8.8			142	247	350	
1943		77.0		8.5			138	248	357	
1944		75.3		9.1			131	249	367	
1945		74.1		7.1	59.6	98	138	241	352	401
1946		77.2		8.7	61.8	94	128	232	338	392
1947		75.9	2.85	7.7	60.4	96	137	238	341	396
1948		77.5	3.31	8.5	60.6	98	133	236	339	391
1949		75.6	2.48	8.6	60.3	95	133	235	341	401
1950		76.9	2.92	8.5	60.8	96	131	233	344	400
1951		77.0	2.42	9.0	61.0	98	133	230	342	397
1952		78.8	2.97	8.6	60.4	101	132	234	343	396
1953		79.6	2.40	8.9	60.7	92	126	227	340	392
1954		79.9		9.2	60.7	96	127	227	325	398
1956	92.1	84.3	2.90	9.4	61.5	98	127	223	323	385
1958	96.1	87.0	3.38	9.2	58.1	100	125	220	327	387
1960	95.9	86.2	3.11	9.6	58.8	94	125	218	320	394
1962	95.9	87.7	3.12	9.0	60.0	102	129	206	311	390
1964	96.6	87.8	2.88	9.3	61.6	94	121	201	303	380
1966	97.2	88.0	3.10	9.5	61.0	93	117	195	302	377
1968	96.9	88.5	3.18	10.1	60.6	93	119	203	314	391

Table V. Average Analysis of Winter Gasolines Regular Grade, 1940 - 1968

Year	Octane Number		Lead, gm./gal.	Vapour Pressure	Gravity, °A.P.I.	Distillation Range, °F.				Sulphur, %	Gum, mgm./100 ml.
	Research	Motor				I.B.P.	10%	50%	90%		
1940		71.2		10.3	62.3	93	131	241	356	0.07	1.9
1945		70.2		8.9	60.1	92	127	247	353	0.06	3.0
1946		72.0		8.7	60.6	95	131	236	347	0.05	3.4
1947		72.9	1.54	9.3	61.4	91	125	238	340	0.05	3.5
1948		73.5	2.09	10.1	61.8	93	128	241	339	0.06	2.1
1949		73.7	2.48	9.5	60.8	90	128	244	336	0.05	2.8
1950		73.3	1.85	10.5	61.1	94	125	242	346	0.05	1.4
1951		74.8	2.27	10.8	62.1	89	118	236	340	0.05	1.4
1952		74.7	1.38	10.8	61.7	99	125	230	334	0.06	1.1
1953		76.9	1.46	10.3	61.0	97	124	231	338	0.04	1.2
1954		77.8		10.8	62.6	93	121	230	332	0.05	0.9
1958	88.3	81.7	2.61	11.5	64.4	94	116	207	312	0.05	1.3
1960	89.6	81.8	2.15	12.4	64.7	86	108	199	318	0.05	1.2
1962	89.8	83.3	1.69	12.4	64.6	92	110	197	317	0.04	0.4
1964	90.6	82.9	1.77	12.2	65.5	87	108	191	303	0.05	0.5
1966	91.4	84.2	2.02	11.9	65.8	87	109	189	295	0.04	0.7
1968	91.3	83.6	2.17	12.2	65.5	89	107	188	302	0.04	0.7

Table VI. Average Analysis of Summer Gasolines Regular Grade, 1940 - 1968

Year	Octane Number		Lead gm./gal.	Vapour Pressure	Gravity °A.P.I.	Distillation Range, °F.				Sulphur, %	Gum, mgm./100 ml.
	Research	Motor				I.B.P.	10%	50%	90%		
1940		69.9		8.7	60.0	100	141	249	360	0.06	0.9
1941		70.8		8.1	59.1	92	138	262	362	0.06	2.0
1945		69.8		6.9	59.1	98	140	247	355	0.04	2.7
1946		72.9		8.3	60.9	96	131	239	342	0.05	5.6
1947		72.5	1.72	7.6	60.5	95	137	242	343	0.06	4.7
1948		73.9	2.24	8.5	60.3	96	132	247	345	0.06	3.4
1949		71.8	1.47	8.6	59.6	93	132	245	346	0.05	6.5
1950		74.0	2.35	8.4	60.5	97	133	241	345	0.06	2.1
1951		74.1	1.68	8.9	60.8	95	131	236	340	0.05	1.6
1952		76.2	2.20	8.3	59.7	100	137	242	345	0.06	1.4
1953		76.8	1.88	9.0	60.8	93	128	232	338	0.05	1.2
1954		77.7		9.4	62.1	97	130	229	328	0.06	1.3
1956	85.9	80.2	2.35	8.8	62.0	95	128	220	318	0.05	2.2
1958	89.9	81.9	2.42	9.2	60.8	100	124	218	325	0.06	1.2
1960	90.1	82.5	2.46	9.6	61.9	93	123	215	328	0.05	1.6
1962	90.2	83.8	2.92	9.0	62.3	100	127	205	320	0.05	0.9
1964	89.9	83.4	2.61	9.0	62.8	96	124	204	305	0.05	0.7
1966	91.4	83.4	2.61	9.7	63.5	94	116	193	305	0.05	0.5
1968	91.4	84.1	2.89	9.9	62.8	92	118	201	316	0.05	0.4

Table VII. Distribution of Failures
Number of Samples Failing Each Specification Test, 1968

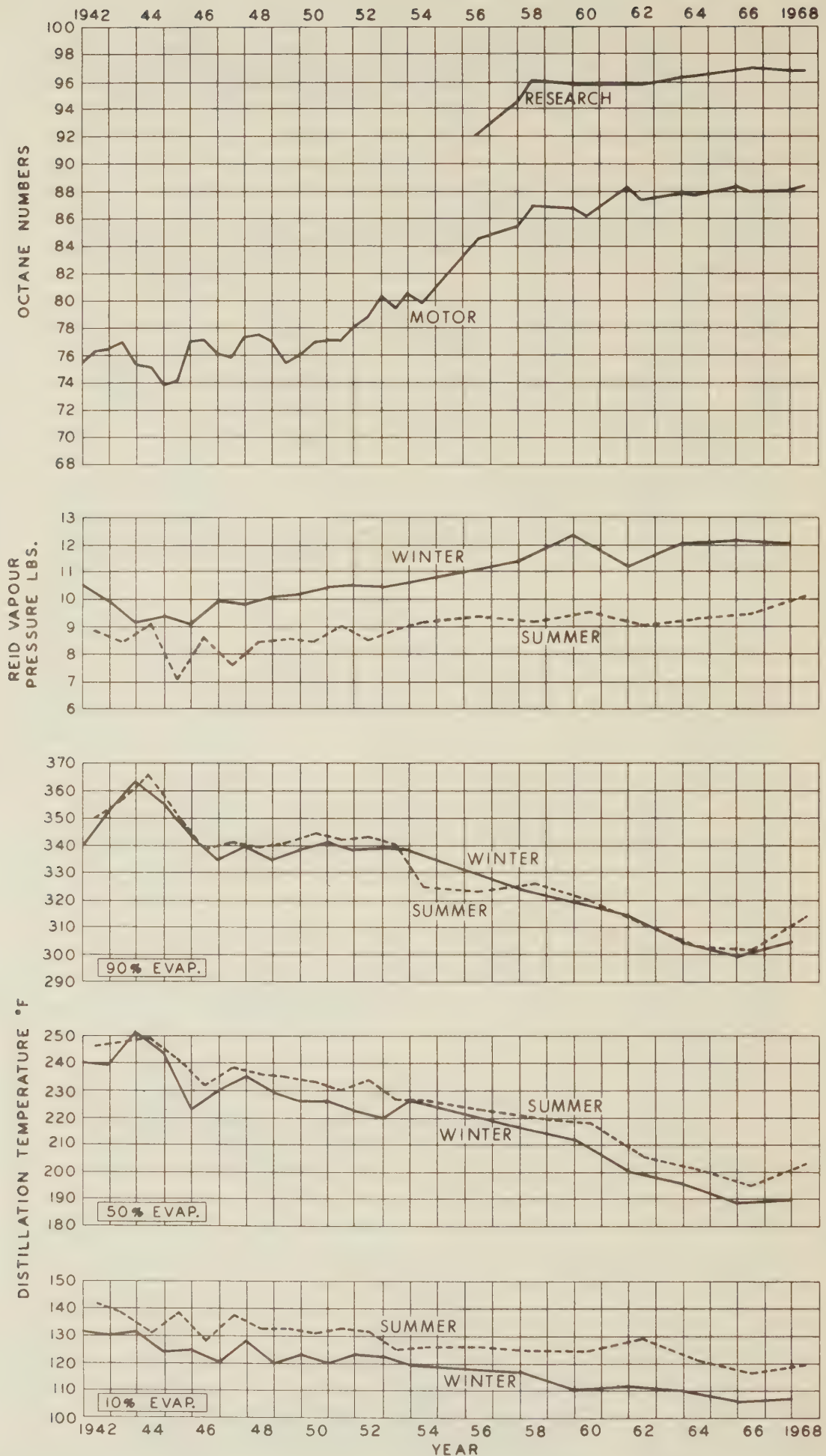
	Premium Grade Gasoline				Regular Grade Gasoline			
	Winter		Summer		Winter		Summer	
	North	South	North	South	North	South	North	South
Octane Number								
Lead								
Vapour Pressure	1		3					
Distillation Range:							1	
10%			1					
50%								
90%								
Sulphur								
Gum	1				1			
Corrosion								
Colour		1			4	1		
Freezing Point								

Table VIII. Average Analysis of 1968 Gasolines, Northern and Southern Alberta

	Premium Grade Gasoline				Regular Grade Gasoline			
	Winter		Summer		Winter		Summer	
	North	South	North	South	North	South	North	South
Octane Number:								
Research	97.1	96.6	97.1	96.8	91.9	90.5	92.0	90.4
Motor	87.8	88.6	88.0	89.2	83.6	83.7	84.4	83.7
Lead, gm./gal.	2.92	2.56	3.34	2.94	1.94	2.51	2.79	3.04
Vapour Pressure, lbs.	12.3	11.9	10.4	9.6	12.2	12.1	10.1	9.7
Gravity, °A.P.I.	64.0	62.3	60.7	60.6	66.1	64.6	63.0	62.6
Distillation Range, °F.								
I.B.P.	88	90	91	96	89	90	91	94
10%	106	110	117	122	107	108	117	119
50%	187	192	207	195	187	190	203	197
90%	310	298	320	304	301	303	319	312
E.P.	380	371	392	390	378	375	391	388
Sulphur, %	0.03	0.03	0.03	0.03	0.04	0.05	0.04	0.06
Gum, mgm./100 ml.	1.9	1.0	*	0.2	0.9	0.5	*	0.4
Corrosion	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Colour	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow

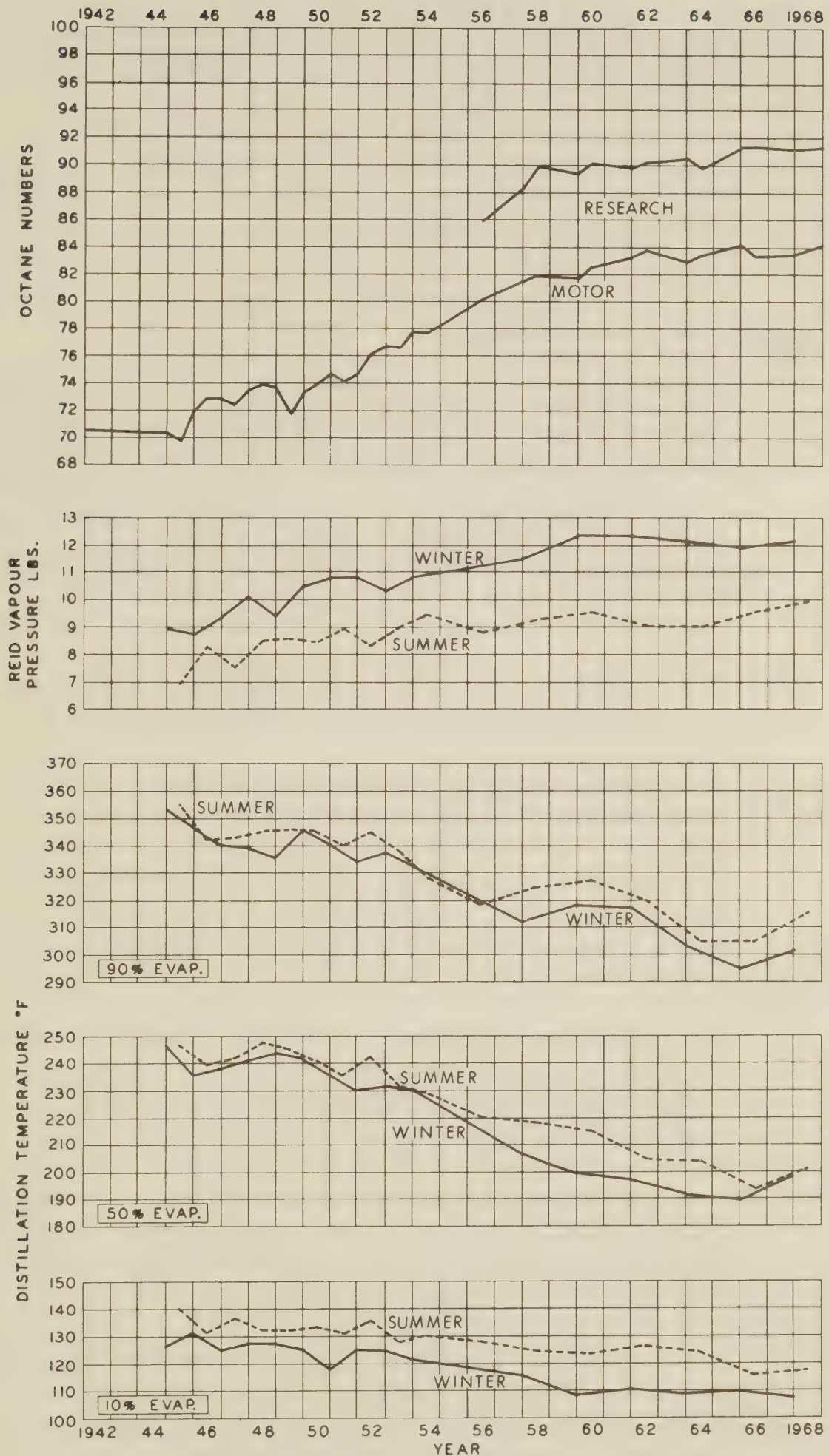
* Due to a breakdown of equipment it was not possible to conduct gum tests on these samples.

FIGURE 1



DISTILLATION-VAPOUR PRESSURE-OCTANE NO. TRENDS
PREMIUM GRADE GASOLINE

FIGURE 2



DISTILLATION-VAPOUR PRESSURE-OCTANE NO. TRENDS
REGULAR GRADE GASOLINE

APPENDIX 1

ALBERTA STANDARD SPECIFICATIONS FOR GASOLINE

(Extract from The Alberta Gazette of June 15, 1962)

STANDARDS

33. In this part and the Schedule A attached, unless the context requires a contrary meaning,

- (a) "Gasoline" means and includes volatile hydrocarbon fuel suitable for use in the lighter internal combustion engines, requiring a carburant fuel, used in motor vehicles; but does not include material known as aviation fuel, nor the heavier fuels in the classes known as kerosene, engine distillate and other fuels suitable only for use in tractors and heavy engines.
- (b) "Minister" means the Minister of Industry and Development.
- (c) "Summer Gasoline" means the gasoline normally sold in the months of May to September (inclusive).
- (d) "Winter Gasoline" means the gasoline normally sold in the months of November to March (inclusive).

34. (a) There are hereby established within the Province two grades of gasoline, namely "Premium" and "Regular" in accordance with the standards set out in Schedule A attached hereto.

(b) No gasoline shall be sold or offered for sale as "Premium" gasoline unless the said gasoline complies in every respect with each and every specification for "Premium" gasoline set out in Schedule A attached hereto.

(c) No gasoline shall be sold or offered for sale as "Regular" gasoline unless the said gasoline complies in every respect with each and every of the specifications for "Regular" gasoline set out in Schedule A attached hereto.

(d) No person shall sell or offer for sale by retail any gasoline other than "Premium" or "Regular" gasoline as established by the standards set out in Schedule A attached hereto, or blended gasoline in accordance with section 35 below.

35. No blend of gasoline with benzol and/or alcohol which

fails to meet the requirements of the standard specifications set out in Schedule A shall be sold or offered for sale until the specification for its manufacture has been submitted to and approved by the Minister.

36. Whenever gasoline is sold or offered for sale a plate or sign clearly indicating to the customer the grade of the gasoline sold or offered for sale must be conspicuously displayed on the gasoline pump or other container from which the gasoline is supplied to the customer. The said gasoline grade plates or display signs shall be of a type and design approved by the Minister.

37. Whenever it appears to the satisfaction of the Minister that the wholesale or retail vendor of gasoline has failed to maintain the standard specifications hereby prescribed, the wholesale or retail licence of the vendor, as the case may be, may be suspended or cancelled by the Minister.

38. No gasoline or naphtha which has a Reid vapour pressure exceeding the values set forth in the standard specifications hereby prescribed shall be sold or offered for sale within the Province.

39. All "Premium" gasoline shall be coloured red, and no gasoline other than "Premium" shall be so coloured.

40. All "Regular" gasoline shall be coloured a distinctive colour, other than red. Such distinctive colour shall be registered with and approved by the Minister, and no other gasoline than "Regular" shall be so coloured.

41. "Summer Gasoline" as set out in the said Schedule A is gasoline intended for sale in the months of May to September (inclusive). "Winter Gasoline" as set out in the said Schedule A is gasoline intended for sale in the months of November to March (inclusive).

42. During the periods in which the changes are being made from summer to winter gasoline and the reverse, that is normally during the months of October and April, a gasoline will be regarded as satisfactory if it complies with either the winter or summer specification for its grade.

43. The standard specifications for gasoline as shown in Schedule A may be modified from time to time as found necessary by the Minister but such modification shall not become effective until ample notification has been given to the operators concerned.

SCHEDULE A

STANDARD SPECIFICATIONS FOR GASOLINE

1. Requirement Specific for Premium Gasoline.

(a) Octane Number: The octane number shall not be less than 95 as determined by the C.F.R. Research Method of A.S.T.M. procedure D-908.

2. Requirement Specific for Regular Gasoline.

(a) Octane Number: The octane number shall not be less than 89 as determined by the C.F.R. Research Method A.S.T.M. procedure No. D-908.

3. Requirements Common to both Premium and Regular Gasoline.

(a) Appearance: The gasoline shall be clear i.e., free from undissolved water and suspended matter.

(b) Corrosion: The gasoline shall not discolour a test strip more than A.S.T.M. Standard No. 1 on the test for corrosion (A.S.T.M. procedure D-130).

(c) Vapour Pressure: The vapour pressure as determined (A.S.T.M. procedure D-323) shall not be less than 9 lbs. for Winter Gasoline and shall not exceed 11 lbs. for Summer Gasoline and 14 lbs. for Winter Gasoline. A vapour pressure one pound greater shall be permitted in each case at the refinery or other point of wholesale delivery.

(d) Sulphur: The total sulphur content as determined (A.S.T.M. procedure D-90 – 34T or D-1266) shall not exceed 0.15 per cent by weight.

(e) Gum: The gum content as determined (A.S.T.M. procedure D-381) shall not exceed 7 mg. per 100 ml.

(f) Freezing Point: For winter gasolines only: The freezing point of the fuel, as indicated by the initial formation of solid matter, shall not be higher than minus 60°F. (Minus 51°C.) The method of determination shall be as in C.G.S.B. specification 3-GP-0/32.1.

(g) Lead Content: The lead content as determined (A.S.T.M. procedure D-526 shall not exceed 5.05 grams per Imperial

Gallon. Lead Alkyls other than tetraethyl lead may be used up to a lead content of 3.80 grams per Imperial Gallon but any increment above this amount shall be achieved by the addition of tetraethyl lead.

(h) Antiknock Compounds: Supplementary antiknock materials (other than lead alkyls) may be used. The name and approximate amount of each shall be reported to the Minister.

(i) Distillation Range: The distillation range shall be as follows:

	Temperature in °F.	
	<u>Summer</u>	<u>Winter</u>
10% of the fuel shall be evaporated between	110-135	95-125
Not less than 50% of the fuel shall be evaporated at	245	235
Not less than 90% of the fuel shall be evaporated at	365	365

(1) The distillation range shall be determined by A.S.T.M. procedure D-86.

(2) The phrase used above, "Not less than 10% of the fuel shall be evaporated at 155°F." is equivalent to the phrase "10% of the fuel shall evaporate at a temperature of not higher than 155°F."

(3) For the purposes of the distillation specification the volume evaporated at any temperature shall be taken as the volume collected plus the distillation loss as determined at the end of the test.

(4) Distillations may be made at any elevation provided that the observed temperatures are corrected to the temperatures that would presumably have been observed if the distillation had been made at normal barometric pressure at sea level.

(5) The observed distillation temperatures may be corrected for the effect of difference between actual barometric pressure and normal pressure at sea level by means of the corrections in the following table "A".

TABLE OF CORRECTIONS FOR DISTILLATION DATA TO ADJUST
FOR VARIATIONS OF BAROMETRIC PRESSURE FROM STANDARD (29.92 inches)

18

4. The tests to be made under the foregoing specifications shall be made on the gasoline as sold, and shall, unless otherwise specified therein be made in accordance with the current procedures for such tests adopted, or tentatively adopted by the American Society for Testing Material (A.S.T.M.) or by the Canadian Government Specifications Board (C.G.S.B.) respectively, or modification of such tests where said modification is introduced for convenience and does not affect the results obtained.

APPENDIX 2

CHANGES MADE IN ALBERTA GOVERNMENT SPECIFICATIONS FOR GASOLINE

Year	1941	1948	1950	1958	1962
Octane Number:					
Motor Prem.	Min. 75	Min. 75	Min. 76		Min. 95
Motor Reg.	Max. 78	Min. 70	Min. 72	Min. 88	Min. 89
Research Prem.	Min. 66	Max. 70		Min. 82	Clear
Research Reg.				Clear	Max. #1
Appearance	Clear	Clear	Clear	Pass	
Copper Corrosion	Pass	Pass	Pass		
Vapour Pressure, lbs.					
Summer	Max. 9.5	Max. 10	Max. 10	Max. 10	Max. 11
Winter	Max. 13	Max. 13	Max. 13	Max. 13	Min. 9
Sulphur, %					Max. 14
Summer	Max. 0.15	Max. 0.15	Max. 0.15	Max. 0.15	Max. 0.15
Winter	Max. 0.10	Max. 0.15	Max. 0.15	Max. 0.15	Max. 0.15
Gum, mgm./100 ml.	Max. 10	Max. 7	Max. 7	Max. 7	Max. 7
Freezing Point, °F.	Max. -76	Max. -60	Max. -60	Max. -60	Max. -60
Lead:					
ml./gal.		Max. 3.6	Max. 3.6	Max. 3.6	Max. 5.05
gm./gal.					Distilled
Distillation Range, °F.	Recovered	Distilled	Distilled	Distilled	Min. 110
10% Summer	Max. 155	Max. 155	Max. 155	Max. 155	Max. 135
Winter	Max. 140	Max. 140	Max. 130	Max. 130	Min. 95
50% Summer	Max. 260	Max. 260	Max. 260	Max. 255	Max. 245
Winter	Max. 257	Max. 255	Max. 250	Max. 255	Max. 235
90% Summer	Max. 360	Max. 370	Max. 370	Max. 370	Max. 365
Winter	Max. 356	Max. 370	Max. 370	Max. 370	Max. 365
Loss, %	Max. 2.5	Max. 2.5			

APPENDIX 3

SIGNIFICANCE OF SPECIFICATIONS FOR MOTOR GASOLINES

A brief discussion of the significance of properties covered by Alberta specifications for gasoline is given below. Requirements covering anti-knock quality and volatility define the general character of a gasoline. The other requirements limit minor components of undesirable nature to concentrations sufficiently low that they will not have an adverse effect on engine performance.

Octane Number or Anti-Knock Quality

The fuel-air mixture in an engine will, under certain conditions, burn spontaneously rather than at a uniform measureable rate through the cylinder. Such spontaneous combustion may be heard as an audible "ping" or knock. Power loss and damage to an engine due to knocking is generally not significant unless the knock intensity is very severe, but prolonged heavy knocking will appreciably decrease power and may damage an engine. In general, the higher the octane number of a fuel, the less will be its tendency to detonate or knock in an engine.

Two engine test methods are used for evaluating the anti-knock quality of gasolines, namely, the Research Method and the Motor Method. While the results of these tests may be translated into approximate field performance figures, there are many exceptions and so hard and fast rules cannot be defined. Changes in atmospheric humidity, altitude and the accumulation of engine deposits may alter the tendency of a fuel to knock by the equivalent of several octane numbers. For most cars, driven in conventional manner, the Research Method usually provides the better guide as to field performance and, for this reason, is the method selected for establishing the octane number values in specifications. The Research octane number indicates the anti-knock performance under mild operating conditions, and these are the conditions which usually exist for most passenger cars and light-duty commercial vehicles. The Motor octane number indicates the anti-knock performance under more severe operating conditions such as are encountered at full throttle and high engine speeds.

Tetraethyl lead and other lead alkyls are added to gasolines to increase their octane numbers. The quantity of lead compounds added must be limited for reasons of health, and to reduce the tendency to develop mechanical troubles due to the formation of engine deposits resulting from the combustion of such materials.

Volatility

One of the most important characteristics of a gasoline is its ability to change from a liquid to gaseous state in the carburetor.

Gasolines which vaporize too readily may boil in the fuel lines causing a stoppage of fuel flow (vapour lock). On the other hand, gasolines which do not vaporize readily enough may cause hard starting, and other difficulties. Obviously weather conditions dictate in this situation, and for this reason volatility limits are changed for summer and winter gasolines.

Volatility limits are usually established in terms of vapour pressure and distillation test results. Together these control starting, warm-up, carburetor icing, acceleration, vapour lock, crankcase dilution, and to some extent fuel economy. The vapour pressure should be high enough, and the 10 per cent distillation temperature low enough, to ensure ease of starting, but not so high or low respectively as to cause vapour lock. A maximum is set for the 50 per cent distillation temperature to ensure adequate warm-up and acceleration. A maximum is set for the 90 per cent distillation temperature to guard against excessive dilution of the crankcase oil with unburned fuel residues.

Impurities

Most gasolines contain small amounts of sulphur compounds. Many, but not all, such compounds are corrosive, and if corrosive material is present even in low concentration corrosion of the metal parts of an engine may result. When gasoline is burned all sulphur compounds present are converted to materials which, in the presence of moisture, are highly corrosive. It is, therefore, desirable to ensure that no corrosive sulphur compounds are present in the gasoline and at the same time keep the total sulphur content of the gasoline as low as practical.

Gum is a sticky resinous material which may form in gasoline during storage. When gasoline evaporates this material is left as a residue. If present in excess, gum may cause the formation of manifold deposits and the sticking of intake valves and carburetor parts.

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Charlesworth, J S
Alberta motor gasoline
survey, 1968.

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